MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

TIC3151 / TES3111 – ARTIFICIAL INTELLIGENCE

(All sections / Groups)

2ND JUNE 2017
3.00 PM – 5.00 PM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages (including cover page) with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

QUESTION 1

(a) Describe the intention of setting up Searle's Chinese Room Experiment. [3 marks]

(b) Provide **ONE** example that shows how a vacuum-cleaner agent as a simple reflex agent reacts in a partially observable environment. [4 marks]

(c) Draw a schematic diagram of a simple reflex agent. [3 marks]

QUESTION 2

(a) Given below are the initial state and goal state of the 4-puzzle problem. Suppose that Manhattan distance is used as its heuristic function. The Manhattan distance is defined as the summation of distances between numbered tiles at the current state and the goal state.

2	3
	1

Initial State

1	2
3	

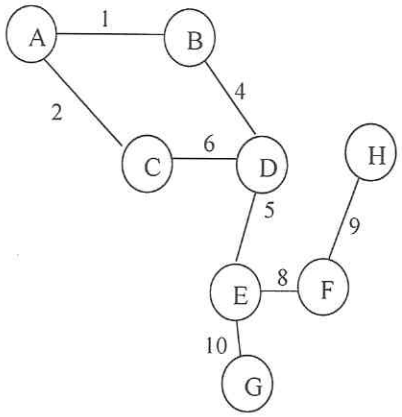
Goal State

(i) What is the heuristic value for initial state? [1 mark]

(ii) Draw the search tree using greedy search algorithm. Label the expanded nodes with appropriate costs. Highlight the solution path on the search tree. [4 marks]

(b) Given below is a graph giving the distances between pairs of cities in kilometre (km). A table containing the straight-line distance heuristic values is also provided. Initial state is at City A. The goal is to arrive at City H.

Straight-line distance to Y	
A	20
B	18
C	12
D	9
E	8
F	7
G	6
H	0



(i) Draw the search tree using A* search algorithm. Avoid repeated nodes. Label the expanded nodes with appropriate costs. [3 marks]

(ii) Based on your answer in Question 2(b)(i), state the solution path and its path cost. [2 marks]

CONTINUED ...

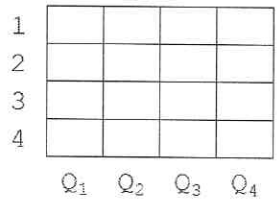
QUESTION 3

(a) Determine whether $(P \vee R) \models (R \Leftrightarrow P)$. [2 Marks]

(b) Convert the sentence $(P \wedge S) \Leftrightarrow R$ to conjunctive normal form. [4 Marks]

(c) The 4-queens problem consists of placing four queens on a 4 x 4 chessboard so that no two queens can attack each other i.e., no two queens are allowed to be placed on the same row, column or diagonal. Each queen is incrementally placed on the chessboard i.e., starting with an empty state.

Your task is to represent the 4-queens as a constraint satisfaction problem with 4 variables $\{Q_1, Q_2, Q_3, Q_4\}$, each of which has domain values $\{1, 2, 3, 4\}$. The value represents where on the chessboard we will place the *i*-th variable, as shown in the following figure:



Let first assign $Q_1=2$. Complete the following table showing the progress of 4-queens search with forward checking. Does it lead to a solution?

	Q_1	Q_2	Q_3	Q_4
Initial Domains	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4

[4 marks]

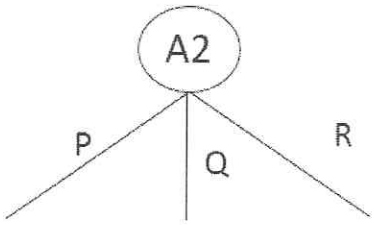
CONTINUED ...

QUESTION 4

The following table shows the training examples with 3 input attributes (A1, A2, A3) and a Class attribute:

A1	A2	A3	CLASS
TRUE	Q	TRUE	YES
FALSE	P	FALSE	NO
FALSE	P	FALSE	NO
TRUE	P	FALSE	YES
TRUE	Q	FALSE	YES
TRUE	Q	FALSE	YES
TRUE	R	FALSE	YES
TRUE	R	FALSE	YES
FALSE	R	FALSE	YES
TRUE	P	TRUE	YES
FALSE	P	TRUE	NO
FALSE	Q	TRUE	YES
TRUE	R	TRUE	NO
TRUE	R	TRUE	NO

The partially learned decision tree resulting from the first step of the ID3 is as follows:



(a) Based on the ID3 algorithm, which attribute should be tested for the first child of the root node (i.e., A2=P)? Show each working steps clearly.

[5 marks]

(b) For the second child of the root node (i.e., A2=Q), should additional test be carried out for this branch of the tree and why?

[2 marks]

(c) Based on your solutions in 4(a) and 4(b), draw the resulting decision tree for the first (i.e., A2=P) and second (i.e., A2=Q) branches of the root node. As for the third (i.e., A2=R) branch of the root node, show the subset examples.

[3 marks]

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